

SECTION 4

RISK EVALUATION

4.1 BACKGROUND

4.1.1 MTCA cleanup regulations listed in WAC 173-340-357 mandate that site cleanups protect human health and the environment. The selection and evaluation of cleanup action alternatives must be demonstrated through the use of either quantitative or qualitative risk assessments. The purpose of the risk assessment is to evaluate current and future adverse health effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these releases.

4.1.2 According to MTCA, the results of the risk assessment should be used in developing cleanup alternatives and to establish acceptable remediation levels for use during the feasibility study. In addition, the risk assessment is used to communicate the magnitude of the risk at the site and the primary causes of that risk, and to aid in the development, evaluation, and selection of appropriate response alternatives.

4.1.3 Risk assessments are site-specific evaluations and may vary in both detail and extent to which qualitative and quantitative inputs are used. The characteristics of the risk assessment depend on the complexity and particular circumstances of the site, as well as the availability of applicable or relevant and appropriate requirements (ARARs) and other guidance. The risk assessment should consider the potential risks associated with current land use and activities, as well as reasonably anticipated future land use. Site conditions following the proposed land transfer to Clark County were evaluated to provide a baseline risk in the absence of any actions to control or mitigate that risk for this risk assessment.

4.2 NATURE OF RISK

4.2.1 The 1997 Presidential/Congressional Commission on Risk Assessment and Risk Management defines risk as follows:

Risk is the probability that a substance or situation will produce harm under specified conditions and is a combination of two factors: (1) the probability that an adverse event will occur, and (2) the consequences of an adverse event.

4.2.2 Washington State Department of Ecology has developed general risk assessment methods for evaluating human health and environmental risks at hazardous and toxic waste sites. These general risk assessment methods are conducted through four basic

steps: (1) hazard identification, (2) dose response modeling, (3) exposure assessment, and (4) risk characterization. These methods are typically used to quantify risk from long-term, chronic exposure to low levels of contamination. MTCA cleanup regulations have no provisions for evaluating ordnance explosive safety risk.

4.2.3 Military munitions at closed or transferred ranges are regulated as solid wastes under WAC 173-303-578 and fall under the category of dangerous wastes under WAC 173-303-090 because of their characteristic of reactivity and/or ignitability. Dangerous wastes are designated as hazardous substances under RCW 70.105.010 and subject to risk assessment requirements under WAC 173-340-357. However, military munitions do not include any wholly inert items (WAC-173-303-040), such as certified inert munitions debris (MD) and expended munitions components that do not pose any explosive safety threat, and therefore these items are not evaluated in this risk assessment.

4.2.4 The risk assessment processes that have been developed for chemical contaminants do not lend themselves to an ordnance explosive safety risk assessment because of the unique properties of military munitions. Thus the potential for human interaction with military munitions needs to be evaluated differently than processes developed for chemical contaminants.

4.2.5 The primary release mechanisms for the occurrence of MEC are related to the type of munitions activity, or result from the improper functioning of the munition. When a munition item (artillery shell) is fired it will do one of three things:

- It will detonate completely. This is called a high order detonation.
- It will undergo incomplete detonation. This is also called low order detonation.
- It will fail to function. This results in unexploded ordnance, UXO.

4.2.6 In addition, MEC may be lost, abandoned, or buried, resulting in non-deployed munitions that could be fuzed or unfuzed.

4.2.7 Munitions demilitarization through open burning/open detonation (OB/OD) is used to destroy excess, obsolete, or unserviceable munitions by combustion (OB) or by detonation (OD). An OD operation can result in high order detonation, low order detonation and UXO. In addition, the munitions may possibly spread beyond the immediate vicinity by the detonation ("kick-outs"). Incomplete combustion can leave uncombusted explosives.

4.2.8 Explosive safety risk is defined as the probability for a military munition to detonate and potentially cause harm as a result of human activities. An explosive safety risk exists if a person can come into contact with a military munition and act upon it to cause a detonation. The threat from military munitions typically results from a single interaction and may have one of three outcomes: no effect, injury, or death.

4.2.9 The potential for an explosive safety risk depends upon the presence of three critical elements: a source (presence of military munitions); a receptor or person; and an interaction between the source and receptor (such as picking up the item or disturbing the item by plowing). There is no risk if any one of these three elements is missing. Each of the elements provides a basis for implementing effective risk-management responses.

4.3 EXPLOSIVE SAFETY HAZARDS

4.3.1 The consequences of a military munitions detonation is associated with physical forces resulting from blast pressure, fragmentation hazards, thermal hazards and shock hazards. Some practice munitions contain an energetic, (low explosive or pyrotechnic charge) and include a fully functional fuzing system, while other practice munitions are wholly inert. A practice round UXO item poses less of a hazard than a HE-filled UXO. The hazard from a practice round UXO may result from a fuze or spotting charge contained in order to produce a flash or smoke upon impact. Unexpended spotting charges may cause a flesh burn. The wholly inert practice items have no explosive parts, including fuze components, and do not pose an explosive safety hazard.

4.3.2 Different types of military munitions vary in their likelihood of detonation and their potential for harm. The classification of energetic materials used in military munitions can be divided by their primary uses: explosives, propellants, and pyrotechnics (U.S. EPA, 2002). Explosives and propellants, if properly initiated, will evolve large volumes of gas over a short period of time. The key difference between explosives and propellants is the reaction rate. Explosives react rapidly, creating a high-pressure shock wave and are designed to break apart a munitions casing and cause injury. Propellants react at a slower rate, creating a sustained lower pressure. Propellants are designed to provide energy to deliver a munition to its target. Pyrotechnics produce heat but less gas than explosives or propellants. Pyrotechnics are used to send signals, to illuminate areas, simulate other weapons during training, and as ignition elements for certain weapons. When initiated, pyrotechnics produce heat, noise, smoke, light or infrared radiation. Incendiaries are a class of pyrotechnics that are highly flammable and are used to destroy a target by fire.

4.3.3 Explosives can be further subdivided into low explosive and high explosive based on the velocity of the explosion. When a HE munition is initiated, it decomposes almost instantaneously and the detonation can be lethal. Low explosives undergo decomposition or combustion at rates from a few centimeters per minute to approximately 400 meters per second (U.S. EPA, 2002). Black powder is a common low explosive and when used as a spotting charge it can cause injury or burns. In a 37mm projectile, the black powder is fully encased and if initiated can be lethal.

4.3.4 The explosive hazards depend upon the nature and condition of the explosive fillers and fuzes. The safety risk associated with practice items is significantly different than HE-filled UXO. For example, an HE-filled UXO (item that has been deployed but failed to function) is more hazardous than a deployed practice item containing a small spotting charge. However it may be difficult to distinguish between the practice and HE-

filled munitions in the field and this difficulty is compounded when the item is buried beneath the surface or subjected to weathering making any markings indistinguishable.

4.3.5 At military training facilities, including Camp Bonneville, it was customary to conduct training exercises using practice munitions, including those ranges designated for use of HE-filled munitions. Only after troops demonstrated proficiency in firing tactics were troops allowed to use HE-filled munitions. As a result, training ranges contain a preponderance of practice munitions. At Camp Bonneville, the ASR report indicated that artillery units only conducted firing exercises about twice per year from 1969 – 1985, resulting in approximately 50 rounds being fired into the Central Impact Area during each training session. Sometime in the 1970's, however the military switched from live ammunition to sub-caliber rounds for training purposes (USACE, 1997). Overall, the likelihood of encountering HE-filled UXO at Camp Bonneville's training ranges is considered small as a result of the small number of firing exercises.

4.4 CAMP BONNEVILLE EXPLOSIVE HAZARDS EXPOSURE ASSESSMENT

4.4.1 Approach

4.4.1.1 Development of a qualitative risk model is an essential component of an MEC risk assessment and is used to help identify the population that is reasonably expected to be exposed to munitions hazards at Camp Bonneville. The qualitative risk model for Camp Bonneville was developed around the three causal elements for an explosive safety hazard: MEC source, receptor, and interaction between the receptor and the MEC.

4.4.1.2 The nature and location of the MEC Source sites was evaluated based on historical records of the MEC-related activities and confirmed munition findings, plus site characterization studies. MEC-related activities describe how munitions were stored, transported, deployed and/or destroyed. The primary MEC-related activities conducted in an area are indicative of the type of explosive safety hazards that are likely to be encountered. The analysis of MEC-related activities at Camp Bonneville is documented in the Camp Bonneville Conceptual Site Model (CSM), which was developed collaboratively with Washington State Department of Ecology, U.S. EPA, Clark County and U.S. Army representatives. The Camp Bonneville CSM resulted in the identification of seven MEC Source site types.

4.4.1.3 The current and future land reuse will determine the amount of activity and potential for interaction between human receptors and an MEC source and is an integral part of the qualitative risk model. The potential for an explosive safety risk exists when there is any direct contact between a source and receptor. The depth of the MEC source and depth and frequency of the intrusive activity serve to characterize the interaction and complete the qualitative risk model.

4.4.1.4 The explosive hazards exposure assessment approach developed for Camp Bonneville addresses each of the three causal elements for an explosive safety hazard. The approach for Camp Bonneville is a site-specific qualitative method that is used to

describe and estimate the relative risk or likelihood of adverse consequences from an ordnance source and human receptor interaction. The approach is a two-step process that provides an initial relative ranking of explosive safety risk. The factors applied in the first step address the MEC source. The factors applied in the second step address the likelihood for interaction between the MEC source and receptor.

4.4.1.5 The factors applied in the first step of developing the qualitative risk model to assess the relative ranking of explosive safety risk take into account the expected munition type, MEC characteristics, and the presence or likelihood of MEC based on the MEC-related activities conducted in an area as confirmed during the site reconnaissance. The second step involves estimating the likelihood for human interaction between an MEC source and a receptor based on site accessibility and future land reuse. The relative risk ranking and likelihood for human interaction are combined to develop an overall explosive hazards exposure score. This scoring can then be used to describe the magnitude of the risk and support the evaluation and selection of appropriate risk management options.

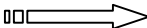
4.4.1.6 The relative ranking of explosive safety risk is based upon the following factors:

- Hazard severity (most hazardous type of munition expected to be found);
- Munition filler (explosive or pyrotechnic); and
- Likelihood of MEC being present (low, medium, or high).

4.4.1.7 The hazard severity is based on findings from past and present studies at Camp Bonneville and is related to the most hazardous type of military munition found or expected in an area. The munition filler factor takes into account whether a military munition is likely to contain high explosives or pyrotechnics. The likelihood of MEC contamination factors in the expected MEC density in a given area. [Table 4.1](#) provides the summary of the explosive safety relative risk ranking (based on the CSM to reflect clearance activities). Each of the primary source areas listed on Table 4.1 is discussed in detail in Sections 4.4.5 through 4.4.12.

4.4.1.8 As shown in Table 4.1, four out of the seven source areas have a “negligible” explosive safety risk; three of these four areas also have a remote likelihood of MEC contamination (i.e., storage magazines/transfer points, training areas, and maneuver areas), and the remaining “negligible” explosive safety risk source area has a medium likelihood of MEC contamination (i.e., firing points). Two areas have a high likelihood of MEC contamination and an explosive hazard greater than negligible (i.e., target areas and OD/OD areas). Lastly, the range safety fans have a critical/catastrophic explosive safety risk, but a low likelihood of MEC contamination. The explosive safety risk for each source area has been assessed irrespective of current or future land use.

**TABLE 4.1
EXPLOSIVE SAFETY RELATIVE RISK RANKING**

MEC Related Activity	Primary Source	Non-deployed munitions	Practice munitions without spotting charge	Practice munitions with spotting charge	Unsuccessfully demilitarized non-deployed ordnance	Unsuccessfully demilitarized deployed ordnance	Deployed munitions that failed to function as designed	Munitions Filler	Likelihood of MEC Contamination	Explosive Safety Relative Risk Ranking
Munitions Storage	Storage Magazines/Transfer Points	X						E, P	Remote	5
Weapons Training	Firing Point	X						E, P	Medium	3
	Target Area						X	E, P	High	1
	Range Safety Fan						X	E, P	Low	4
Troop Training	Training Area		X	X				P	Remote	7
	Maneuver Area	X						P	Remote	6
Munition Demilitarization	Open Burn/Open Detonation Area				X	X		E, P	High	2
		4 (Negligible)	4 (Negligible)	4 (Negligible)	3 (Marginal)	2 (Critical)	2/1(Critical/ catastrophic)	Munitions Filler: E =Explosive P = Pyrotechnic		Highest Explosive Safety Relative Risk Ranking is 1 and Lowest is 7
		Least Severe					Most Severe			
		Hazard Severity Ranking								

The explosive safety risk can be reevaluated as necessary if future removal actions identify conditions not anticipated in the MEC CSM.

4.4.1.9 The second step of the explosive hazards exposure assessment for Camp Bonneville involves an evaluation of the likelihood for interaction between an MEC source and receptor. The likelihood for interaction between an MEC source and receptor is evaluated for current land use and future land use. The land use, accessibility of an area, and activity level(s) of subsurface intrusion influence the potential for human interaction with an MEC item. The likelihood for interaction is based on three primary factors:

- Accessibility factor (related to the slope of the terrain and vegetation density);
- Land use intensity (low, medium, or high); and
- Depth of activity (surficial or subsurface based on the land use).

4.4.2 Exposure Hazards Assessment – Current Land Use

4.4.2.1 As noted previously, vehicular access to Camp Bonneville is restricted to a single entrance and the facilities manager monitors this entrance. With the exception of training conducted at the FBI Range, there is no current use of the Camp Bonneville property (grants for use of the site were cancelled beginning in November 1996). The FBI Range, located within a former range fan area, has no intrusive activities associated with it, and therefore, the likelihood of interaction between a receptor and a historic MEC source is negligible.

4.4.2.2 Other possible receptors include trespassers accessing Camp Bonneville from adjacent properties. The location and history of Camp Bonneville is well known to the local community and it is unlikely that anyone would wander onto the property without the knowledge that it was a former military installation. Although there are no documented accounts of trespassers, the possibility exists for people to illegally access Camp Bonneville. These trespassers would likely be hikers, and due to generally dense vegetation and steep terrain, it is expected that the hikers would remain on existing trails and roads. The likelihood of interaction between a receptor and a historic MEC source is considered negligible because all roads and trails within Camp Bonneville were searched for UXO during the 2002 reconnaissance effort.

4.4.2.3 Overall, the risk associated with current land use activities is considered negligible because there is very limited possible interaction between receptors and an ordnance source.

4.4.3 Exposure Hazards Assessment – Future Land Use

4.4.3.1 The proposed future land use is recreational with varying levels of reuse intensity. The future land reuse intensity was determined based on the January 2003 Camp Bonneville Preliminary Site Plan. This factor takes into account the relative number of potential receptors and frequency they are likely to enter a given area. The undeveloped land within the proposed wildlife management area was designated as low reuse intensity. This includes the central impact area and DNR leased lands. Those areas within the proposed Regional Park that are located between specific designated reuses (classrooms, recreation vehicle [RV] camping, parking, etc.) were assigned medium reuse intensity. Roads and trails and specific designated reuse areas (classrooms, RV camping, parking, etc.) were assigned high reuse intensity.

4.4.3.2 The accessibility of an area reflects the ease of public access based on the presence or absence of roads and trails and slope of terrain. Sites with limited accessibility are not only very difficult to access, but do not pose the same level of hazard as an accessible site containing the same relative explosive safety risk. The accessibility factor for a given source area was designated one of three categories: accessible, limited, or inaccessible. An area was assigned one of the three accessibility factors using the terrain slope record in waypoints recorded during the site reconnaissance and then modified accordingly based on the presence or absence of roads and trails. The initial accessibility factor was assigned accessible if the terrain slope was described as flat or

gentle; limited if the terrain slope was moderate; or inaccessible if the terrain slope was described as steep or cliff. If a road or trail traversed an area, or is within 50 feet of the area, it was designated as accessible.

4.4.3.3 The depth distribution of MEC is not included as an evaluation factor in the ranking of explosive risk since all historical UXO findings at Camp Bonneville were at a depth of less than 18 inches below ground surface. However, the depth distribution of UXO findings is considered in developing site-specific cleanup levels.

4.4.3.4 Different activities involve different levels of subsurface intrusion and affect the potential for coming into contact with an ordnance item. The depths of activities likely to be conducted in those areas designated as high land reuse intensity were further categorized into surficial or subsurface based on the January 2003 Camp Bonneville Preliminary Site Plan. Representative surficial activities include hiking, picnicking, RV camping, archery, outdoor studies, education, and training. Subsurface intrusive activities include road repair and maintenance, camping, and new building construction for the proposed reuse and/or future expansion. The level of subsurface intrusion or depth of activity is designated as not applicable (NA) for those sites that are not located in high reuse intensity areas in the following summary tables contained in this section (only portions of the high reuse areas have proposed subsurface intrusive activities).

4.4.4 Source Type Exposure Hazards Assessment -Future Land Use

4.4.4.1 This following section describes the application of the explosive hazards exposure assessment for Camp Bonneville. An explosive hazards exposure assessment is presented for each of the seven primary MEC source types identified for Camp Bonneville:

1. Target Areas;
2. Open Burn/Open Detonation Areas;
3. Firing Points;
4. Range Safety Fans
5. Storage Magazines/Transfer Points;
6. Maneuver Areas, and
7. Training Areas

4.4.4.2 The source type areas are discussed in the order of their explosive safety relative risk ranking. The first two (Target Areas and OB/OD Areas) are similar in that both have a high likelihood of ordnance contamination coupled with an explosive risk of “marginal” or greater. The last three areas (Storage/Transfer, Maneuver Areas, Training Areas) are similar in risk (“negligible”) and likelihood of MEC contamination (remote). The firing points and range safety fans fall between these two groupings.

4.4.4.3 In addition, the Central Impact Area which has MEC characteristics of both the range safety fan and target area source types; and is evaluated separately because of the potential presence of UXO in this area.

4.4.5 Target Areas

4.4.5.1 The Target Area MEC Source sites at Camp Bonneville consist of eight (8) target areas. Three of these target areas (West Impact Area Car Target 2, Combined Impact Area 1, and Combined Impact Area 2) comprise the sum of all identified target features located within the Central Impact Area. These three MEC Source sites are located outside the proposed regional park. The Central Impact Target Area is addressed separately in Section 4.4.4.

4.4.5.2 Additional Target Areas MEC Source sites include the 3.5-inch Rocket Range Target, Rifle Grenade Range Target, and Hand Grenade (HE) Range Target. These sites are located outside the boundary of the proposed regional park. Additionally, the M203 HE Grenade Range Target and 2.36-inch Rocket Target are Target Area MEC Source sites that are located within the proposed regional park boundary. Locations of Target Areas are shown in [Figure 4.1](#). The positional locations of Target Areas MEC Source sites were confirmed during the site reconnaissance. Evidence of Target Areas included target area features, such as automobile / appliance targets, engineered wooden structures, and expended MEC items located downrange.

4.4.5.3 No UXO were identified or recovered during the site characterization in the 3.5-inch Rocket Range, Rifle Grenade Range or Hand Grenade (HE) Range; nor were any historical ordnance discoveries reported in these areas. A total of four (4) UXO items were recovered in the intrusive grid sampling at the M203 HE Grenade Ranges during the 1998 site characterization. An additional four (4) UXO items were recovered on the ground surface as the intrusive sampling teams were moving between sampling grids at the M203 Ranges. The recovered items were 35mm M73 practice rockets. The 35mm M73 practice rocket may still contain a small explosive safety risk due to the unconsumed signaling charge if it is fired, and fails to function. No 40mm HE or LAW HEAT munition items were encountered, and observations of the range revealed no indication of their presence (i.e., fragmentation marks, singed holes, explosive component debris). An interim removal action (TCRA) was performed at the M203 ranges in 1999. This clearance was conducted on 19 acres to a depth of two (2) feet. No UXO items were recovered during the interim removal action at the M203 HE Grenade Range. Over 3,800 pounds of inert OE scrap were recovered from the M203 Ranges during this clearance action.

4.4.5.4 One (1) intact 2.36-inch rocket was identified embedded near a tree on the east side of Munsell Hill during the 2001 site reconnaissance. This area was selected for reconnaissance due to the presence of ground scars that were identified from historic aerial photos. The 2.36-inch rocket was destroyed in place by the 707th Ord Co (EOD), Fort Lewis, Washington in February 2003. A buried 3.5-inch practice rocket was also reported being found near this location in the ASR (USACE, 1997). No evidence of any 3.5-inch rockets was found during the site reconnaissance at the reported location.

Figure 4.1 Target Area Location Map

4.4.5.5 The munition release mechanism resulting in the presence of MEC in the vicinity of the Target Areas is from deployed munitions that failed to function (UXO) and low-order detonation. Residual UXO poses the greatest explosive safety threat to the public as these items are fuzed and armed but failed to function. The hazard severity ranking for a Target Area is the most severe of all site types. The explosive safety relative risk ranking for Target Areas is 1 on a scale of 1 – 7 with 1 representing the highest explosive risk.

4.4.5.6 The accessibility of the M203 HE Grenade Range Target Area and Hand Grenade (HE) Range Target Area are designated as accessible based on a flat or gentle topographic slope and adjacent roadways. The accessibility of the other Target Areas is categorized as limited, based on a moderate topographic slope. The planned FBI Firing Range (different location than the existing FBI Range) and Law Enforcement Ranges overlie portions of the 3.5-inch Rocket Range, Rifle Range, and Hand Grenade (HE) Range Target Areas, and therefore are designated a high reuse intensity. The activities that will be conducted at the proposed firing range locations that overlie the historical Target Areas are categorized as surficial and non-intrusive activities.

4.4.5.7 The explosive hazards exposure assessment ranking for Target Area MEC Source sites was assigned Rank A on a scale of A – E with A representing the greatest exposure risk. This ranking is due to the high relative explosive safety risk of Target Areas and their locations within the proposed Regional Park and/or co-location with high reuse areas. The M203 HE Grenade Range Target Area was assigned Rank D because of the prior removal action completed in that area and medium (non-intrusive) future reuse. The explosive hazards exposure characteristics associated with Target Areas are summarized in [Table 4.2](#).

4.4.6 Central Impact Target Area

4.4.6.1 The Central Impact Target Area MEC Source site is composed of three adjacent target areas, known as the West Impact Area Car Target 2, Combined Impact Area 1, and Combined Impact Area 2. The Central Impact Target Area is located in the central portion of Camp Bonneville ([Figure 4.2](#)) and comprises approximately 83 acres. This area is unique in that all six mortar and seven artillery firing positions could each fire into the Central Impact Target Area. The acreage of target areas were defined by a probability analysis using Field Manual No. 6-40 (HQDA, 1996), and calculating the spatial distribution of OE items fired from a fixed point to a fixed point based on the 96th percentile. An additional 100-foot buffer was then added to the 96th percentile area. [Figure 4.3](#) shows a graphical representation of this spatial analysis. The Central Impact Target Area was segregated from the other target areas as it may require a different risk management strategy because of the greater potential for larger sized HE-filled UXO located in this area and its remote location.

TABLE 4.2
SUMMARY OF EXPLOSIVE HAZARDS EXPOSURE CHARACTERISTICS
FOR TARGET AREAS

Site	MEC Source	Receptor Interaction			Explosive Hazards Exposure Rank
	Explosive Relative Risk Ranking	Accessibility	Future Land Reuse	Depth of Activity / Reuse ¹	
3.5-inch Rocket Range Target	1	Limited	High	Surface / Firing Range	A
Rifle Grenade Range Target	1	Limited	High	Surface / Firing Range	A
Hand Grenade (HE) Range	1	Accessible	High	Surface / Firing Range	A
M203 HE Grenade Range	* ^{/2}	Accessible	Medium	NA / Regional Park	D
2.36-inch Rocket Target Area	1	Limited	Medium	NA / Regional Park	A

(1) The level of subsurface intrusion or depth of activity is designated as not applicable (NA) for those sites that are not located in high reuse intensity areas.

(2) Removal Action completed to a depth of two feet in the M203 HE Grenade Range Target in 1999.

4.4.6.2 The frequency of use of the Central Impact Target Area is identified in the ASR. The ASR report indicated that artillery units conducted firing exercises at Camp Bonneville twice a year from 1969 – 1985, resulting in approximately 50 rounds being fired into the Central Impact Target Area during each training session. Sometime in the 1970's, however the military switched from live ammunition to sub-caliber rounds for training purposes.

4.4.6.3 MEC release mechanisms that may have resulted in the presence of MEC at the Central Impact Target Area are from deployed munitions that failed to function. UXO items that are potentially present and pose the greatest explosive safety threat include HE-filled munitions ranging in size from 4.2-inch mortars to 155mm artillery rounds. Four (4) UXO items were recovered during the site characterization of the Central Impact Area. These recovered UXO items, including one 2.36-inch HE rocket and three 105mm HE-filled artillery rounds, were located in the Central Impact Target Area. Additionally, one (1) 105mm artillery round was identified during the 2001 site reconnaissance within this Central Impact Target Area.

4.4.6.4 Residual HE-filled UXO items potentially present in the Central Impact Target Area pose the greatest hazard severity ranking of all site types. The likelihood that additional UXO items are present in the Central Impact Target Area is considered high. The high severity ranking and likely presence for additional UXO result in an explosive safety relative risk ranking of 1 on a scale of 1 – 7 for the Central Impact Target Area.

4.4.6.5 The Central Impact Target Area is partially accessible by 4-wheel drive roads, although the majority of it is nearly inaccessible due to very steep terrain. This area is

Figure 4.2 Central Impact Target Area Location Map

Figure 4.3 Figure 4.2 Central Impact Target Area Probabilistic Model

designated a low reuse intensity as it is located within the Wildlife Management Area and there are no designated reuse or facilities planned in this area. The Central Impact Target Area is wholly contained within a fenced area with signage warning trespassers of potential for danger. People are not expected to venture into this area due to the fencing, signage and steep terrain. As a result, there are very few potential human receptors. The high likelihood of an MEC source combined with the very limited number of potential receptors in the area, results in an explosive hazards exposure assessment ranking of Rank B for each of the targets in the Central Impact Target Area. The explosive hazards exposure characteristics associated with the Central Impact Target Area is summarized in [Table 4.3](#).

TABLE 4.3
SUMMARY OF EXPLOSIVE HAZARDS EXPOSURE CHARACTERISTICS
FOR CENTRAL IMPACT TARGET AREA

Site	MEC Source	Receptor Interaction			Explosive Hazards Exposure Rank
	Explosive Relative Risk Ranking	Accessibility	Future Land Reuse	Depth of Activity / Reuse ¹	
West Impact Area Car Target 2	1	Limited	Low	NA / Wildlife Mgt Area	B
Combined Impact Area 1	1	Limited	Low	NA / Wildlife Mgt Area	B
Combined Impact Area 2	1	Limited	Low	NA / Wildlife Mgt Area	B

⁽¹⁾ The level of subsurface intrusion or depth of activity is designated as not applicable (NA) for those sites that are not located in high reuse intensity areas.

4.4.7 Open Burn/Open Detonation Areas

4.4.7.1 The OB/OD MEC Source sites consists of three OB/OD sites at Camp Bonneville, known as Demolition Area 1, 2 and 3. Demolition Area 1 is located in the northwest quadrant of the site, east of Little Elkhorn Mountain; Demolition Area 2 is located adjacent to and west of the Central Impact Area; while Demolition Area 3 is located in the southwest quadrant of the site adjacent to Lacamas Creek and the natural gas pipeline ([Figure 4.4](#)).

4.4.7.2 Demolition Area 1 sits atop Landfill 4. Landfill 4 was used for disposal of building demolition debris from the Vancouver Barracks and possible military wastes (Shannon and Wilson, 1999). The USACE has conducted an interim removal action and physically removed Demolition Area 1 (2.5 acres) in 2004 as part of the Landfill 4 removal action.

4.4.7.3 Demolition Area 1 was reportedly used by the Air Force and Army Explosive Ordnance Disposal (EOD), local fire departments and law enforcement agencies (USACE, 1997). It was used for destruction of unserviceable munitions, and confiscated

Figure 4.4 Open Burn/Open Demolition Area Location Map

firearms and fireworks since the late 1950's. The ASR reported that the Demolition Areas were used to destroy 20mm ammunition, 2.75-inch rockets, and one AIM 7E missile. The rocket motors were destroyed by burning and the warheads destroyed by detonation. The ASR also reported that automobiles, railroad ties, and other objects were brought onto the range for explosive training. Since 1993, the destruction of unserviceable munitions by any method (burning or detonation) was not permitted.

4.4.7.4 A wide range of explosives and ordnance were disposed of at the OB/OD areas. During the site characterization, a 2.36-inch HEAT rocket and an HE-filled 2.75-inch rocket were recovered in the vicinity of Demolition Area 1/Landfill 4. As a result of these findings, a 10-acre surface clearance was performed at Demolition Area 1/Landfill 4. Eight UXO items were recovered during the surface clearance and included two HE-filled 2.75-inch rockets and six 35mm M73 practice rockets. Also, a 4.5-inch rocket was recovered near Demolition Area 3.

4.4.7.5 The demolition of discarded or unused military munitions may sometimes result in the "kick-out" of munitions to some distance from the demolition area. Munition release mechanisms that may have resulted in the presence of MEC in the vicinity of an OB/OD Areas are from UXO kick-outs, and low-order or incomplete detonation. At an OB/OD area, the unsuccessful demilitarization of a UXO item poses the greatest explosive safety threat to the public. The hazard severity ranking for an OB/OD Area is the second most severe of all MEC Source site types (marginal/critical explosive safety hazard). The explosive safety relative risk ranking for OB/OD Areas is 2 on a scale of 1 – 7 with 1 representing the highest explosive risk.

4.4.7.6 The three OB/OD sites are accessible by roads and trails. Demolition Areas 1 and 2 are located outside the boundary of the proposed regional park. A "Logging Camp" is proposed at the location of Demolition Area 2, and this site is therefore designated high reuse intensity. Intrusive activities may be conducted in the logging camp. The explosive hazards exposure assessment ranking for Demolition Area 2 is Rank A because of the potential intrusive activities, site accessibility, and high relative explosive risk ranking. Demolition Area 3 is not within any designated reuse area, but is north of the planned Environmental Study Area (ESA); it is designated a medium (non-intrusive) reuse intensity. The explosive hazards exposure ranking for Demolition Area 3 is Rank A because of the potential for human interaction due to its accessibility and proximity to the planned ESA in combination with the high relative explosive risk ranking. The explosive hazards exposure ranking for Demolition Area 1 can be subdivided into two areas. The immediate OB/OD area for Demolition Area 1 (2.5 acres) is Rank E because it has physically been removed in 2004 as part of the Landfill 4 removal action. The surrounding kick-out area associated with Demolition Area 1 is Rank B. The kick-out area associated with Demolition Area 1 is lower than the other two OB/OD areas primarily because a ten acre surface sweep was conducted in 1998, and there are expected to be fewer potential receptors as it is located in the proposed Wildlife Management Area (WMA) which is a low reuse intensity area. The explosive hazards exposure characteristics associated with each of the OB/OD Areas are summarized in [Table 4.4](#).

TABLE 4.4
SUMMARY OF EXPLOSIVE HAZARDS EXPOSURE CHARACTERISTICS
FOR OB/OD AREAS

Site	MEC Source	Receptor Interaction			Explosive Hazards Exposure Rank
	Explosive Relative Risk Ranking	Accessibility	Future Land Reuse	Depth of Activity / Reuse ¹	
Demolition Area 1 (Kick-out area only) ²	2	Accessible	Low	NA / Wildlife Mgt Area	B
Demolition Area 2	2	Accessible	High	Subsurface / Logging Camp	A
Demolition Area 3	2	Accessible	Medium	NA / Regional Park	A

- (1) The level of subsurface intrusion or depth of activity is designated as not applicable (NA) for those sites that are not located in high reuse intensity areas.
- (2) The OB/OD area associated with Demolition Area 1 was removed in 2004 and has an explosive hazard exposure rank E.

4.4.8 Firing Points

4.4.8.1 The Firing Points MEC Source Site type at Camp Bonneville consist of six mortar firing positions, seven artillery firing positions, one rifle grenade range firing point, one 3.5-inch rocket range firing point, and one M203 40mm HE Grenade Range (Range 4). Firing Points are located near the apex of each range. The positional location of each Firing Point was confirmed during the site reconnaissance. No UXO items were discovered at any Firing Points locations during the reconnaissance efforts. The location of each Firing Point is shown in [Figure 4.5](#).

4.4.8.2 A wide variety of ordnance may have been used at the Firing Point locations. The ASR (USACE, 1997) described the munitions potentially used at each of the Firing Points. The six mortar firing points may have included 4.2-inch, 60mm and 81mm mortars filled with either HE or pyrotechnics. The artillery firing positions included 105mm and 155mm Howitzers and 37mm sub-caliber devices. A variety of rifle grenade munitions may have been used at the rifle grenade range including practice, smoke, white phosphorus (WP), fragmentation, and HEAT. Practice, HEAT, WP, or smoke-filled 3.5-inch rockets may have been used at the 3.5-inch rocket range.

4.4.8.3 The ordnance release mechanism at Firing Points is a result of abandonment, burial, or mishandling of non-deployed munitions in shallow pits. Any residual military munitions would likely be located at a close distance behind the Firing Point location where the munitions were prepared. The likelihood that military munitions are present at a Firing Point location is medium.

Figure 4.5 Firing Point Location Map

4.4.8.4 Only non-deployed military munitions are anticipated to be present at Firing Points. The type of ordnance utilized at a particular firing position would determine if the item was internally or externally fuzed. Military munitions require a specific action, i.e., turning of timer rings, or applying power or force in order to activate the fuzing system. Most artillery munitions are required to be fired in order to activate the fuzing mechanism. If a military munition has not been acted upon, the fuzing has not been activated, and the overall probability that the munition can be detonated by a person uncovering or picking up the item is extremely remote. However, if the item were to be acted upon in an inappropriate, specific and forceful manner, i.e., applying heat or pressure to the outside casing, it could detonate. The hazard severity ranking for a Firing Point location is considered very low (negligible explosive safety hazard). Due to the “medium” likelihood of MEC contamination, however, the explosive safety relative risk ranking for Firing Points is 3 on a scale of 1 – 7, with 1 representing the highest explosive risk.

4.4.8.5 The Firing Points are categorized as accessible based on their proximity to roads. Although Mortar Firing Positions 1, 2, and 5 are located outside the proposed regional park, within the wildlife management area, they are in very close proximity to the proposed park boundary and are therefore designated a medium reuse intensity. Any Clark County-proposed future use areas which overlie the Firing Point locations have activities which will be non-intrusive. Artillery Position 5 overlies the planned Trailhead & Parking Area and the 3.5-inch Rocket Range and Rifle Grenade Range firing positions overlie the FBI and Law Enforcement Firing Ranges.

4.4.8.6 The explosive hazards exposure assessment ranking for Firing Points which overlie a proposed future use area was assigned Rank B on a scale of A – E, with A representing the greatest exposure risk. Other Firing Points were assigned Rank C based on a combination of accessibility and future land reuse criteria. The M203 HE Grenade Range Firing Point was assigned Rank D because of the prior removal action completed in that area. The explosive hazards exposure characteristics associated with Firing Points are summarized in [Table 4.5](#).

4.4.9 Training Areas

4.4.9.1 Camp Bonneville contained a wide variety of troop training areas. Some of these training areas utilized small arms ammunition such as the rifle, pistol, known distance firing ranges, pop up target ranges, and the close combat course. Other training areas utilized no ammunition, such as the bayonet and obstacle courses. Training areas evaluated in this section include the Practice Hand Grenade Range, Training Land Mine Range, Artillery Training Ranges (14.5mm sub-caliber), and M203 40mm Practice Grenade Range, and Range 8 - Mortar Practice Training Range. Training Area locations are shown in [Figure 4.6](#).

**TABLE 4.5
SUMMARY OF EXPLOSIVE HAZARDS EXPOSURE CHARACTERISTICS
FOR FIRING POINTS**

Site	MEC Source	Receptor Interaction			Explosive Hazards Exposure Rank
	Explosive Relative Risk Ranking	Accessibility	Future Land Reuse	Depth of Activity / Reuse ¹	
Mortar Firing Pos 1	3	Accessible	Medium	NA / WMA	C
Mortar Firing Pos 2	3	Accessible	Medium	NA / WMA	C
Mortar Firing Pos 3	3	Accessible	Medium	NA / Regional Park	C
Mortar Firing Pos 4	3	Accessible	Medium	NA / Regional Park	C
Mortar Firing Pos 5	3	Accessible	Medium	NA / WMA	C
Mortar Firing Pos 6	3	Accessible	Medium	NA / Regional Park	C
Artillery Pos 1	3	Accessible	Medium	NA / Regional Park	C
Artillery Pos 2	3	Accessible	Medium	NA / Regional Park	C
Artillery Pos 3	3	Accessible	Medium	NA / Regional Park	C
Artillery Pos 4	3	Accessible	Medium	NA / Regional Park	C
Artillery Pos 5	3	Accessible	High	Surface / Trail Head & Parking	B
Artillery Pos 6	3	Accessible	Medium	NA / Regional Park	C
Artillery Pos 7	3	Accessible	Medium	NA / Regional Park	C
Rifle Grenade Range	3	Accessible	High	Surface / Firing Range	B
3.5-inch Rocket Range	3	Accessible	High	Surface / Firing Range	B
M203 HE Grenade Range	^{/2} *	Accessible	Medium	NA / Regional Park	D

(1) The level of subsurface intrusion or depth of activity is designated as not applicable (NA) for those sites that are not located in high reuse intensity areas. WMA = Wildlife Management Area.

(2) Removal Action completed to a depth of two feet in the M203 HE Grenade Range Target in 1999.

4.4.9.2 The Practice Hand Grenade Range was located west of the Live Hand Grenade Range. No UXO or MEC items have been identified in this area based on historic records or during the site characterization activities. An Mk1A1 training hand grenade made of cast iron would have likely been used for practice in grenade throwing at the Practice Grenade Range. This item contains no explosive components and does not pose any explosive safety risk. The Practice Grenade Range does not possess an MEC Source risk, and is not carried forward to the Feasibility Study (FS).

4.4.9.3 The Practice Landmine Training Area was located west of the Mortar Practice Training Range. No UXO or MEC items have been identified in this area based on historic records or during the site characterization activities. The Practice Land Mine Training Area was used for training in the proper methods and precautions in arming and disarming of HE antipersonnel mines. The practice antipersonnel mine, M68 is completely inert and was reportedly used in this area. This item contains no explosive components and does not pose any explosive safety risk. The Practice Landmine Training Area does not possess an MEC Source risk, and is not carried forward to the Feasibility Study.

Figure 4.6 Training Location Area Map

4.4.9.4 The ASR report indicated the locations of four 14.5mm sub-caliber ranges. Two of these ranges are located along the south and southwest perimeter of the M203 HE Grenade Range. The third 14.5mm range is co-located with the Mortar Practice Training Range, while the fourth 14.5 mm range is located west of the 3.5-inch Rocket Range and is referred to on ASR maps as the M-31 Artillery Range. The 14.5mm cartridge is a sub-caliber munition for training simulations for a 75mm to 155mm Howitzer. Two versions have either 1) a delay element (fuzing), providing an airburst of a loud report and a puff of smoke or, 2) contained an internal percussion fuze and upon impact produces a loud report and a puff of smoke. Munitions that are 30mm and smaller are classified as small arms by the U.S. Military (USACE, 1994). The 14.5mm is considered small arms and pose a very low explosive safety threat to the public.

4.4.9.5 For small arms a deliberate effort must be applied to a very specific and small point (the primer) to make the round function. If the round functions outside the weapons chamber, the propellant gas would cause the bullet and cartridge to separate and, in addition, the cartridge could also rupture. If this took place in close proximity to a person, possible injury could result (USACE, 1999). The explosive safety risk posed by small arms ammunition is very small and is not further discussed in this report.

4.4.9.6 Maps in the ASR report indicate that Range 8 was used for LAW sub-caliber (35mm M73) and the M203 practice projectiles (M382 and M781). This area was also co-located with the Mortar Practice Training Range and a 14.5mm Range. USAESCH conducted an interim removal action to clear MEC items to a depth of two feet within the M203 Practice Range. A total of three (3) 40mm M382 practice projectiles were recovered during this removal action. These three UXO items were located at a depth of less than 2 inches below ground surface. These items are classified as UXO because of a small spotting charge. The 40mm M382 practice projectile if fired, and failed to function, may still contain a small explosive safety risk due to the unconsumed signaling charge. This item is not lethal but can cause bodily injury from the unconsumed signaling charge.

4.4.9.7 Several thousand expended 40mm practice projectiles (M781) and 35mm M73 practice rockets were also recovered at depths ranging from 0 – 14 inches below ground surface during the removal action in the M203 Practice Range. These items were determined to be inert and pose no explosive safety risk.

4.4.9.8 Practice 60mm and 81mm mortar rounds (M68 and M69, respectively) were constructed of cast iron and were used at the Mortar Practice Training Range during the 1940 – 1960s time frame. If fired, these items pose no explosive safety risk. Later variants, known as the 60mm Sabot and 81mm Sabot (M3 and M1, respectively), were reusable and incorporated the 22mm sub-caliber cartridges, M744 series. The M744 series cartridges contained a small signaling charge. If fired, and failed to function, these items may still contain a small explosive safety risk due to the unconsumed signaling charge.

4.4.9.9 During the removal action conducted in the M203 Practice Range, 43 sand-filled Stokes Mortars were recovered. The practice stokes mortars have cast iron bodies

and dummy fuzes. These items were determined to be inert, and pose no explosive safety risk.

4.4.9.10 The M203 Practice and Mortar Practice Training Ranges are co-located in Range 8 and readily accessible. UXO has been recovered in this area and a removal action to a depth of 2 feet has been completed. The likelihood that any UXO remains at this site is extremely remote. The area is designated as high reuse intensity since it is located inside the Regional Park, and is proposed for a Tent and Yurt Camping Site. Construction of Yurt camping sites may include grading and excavation. Intrusive activities associated with camping include driving tent stakes into the ground and excavation of fire pits. The remote probability of UXO being present in this area following the removal action, results in an explosive hazards exposure assessment ranking of Rank D. The explosive hazards exposure characteristics associated with the identified Training Area is summarized in [Table 4.6](#).

TABLE 4.6
SUMMARY OF EXPLOSIVE HAZARDS EXPOSURE CHARACTERISTICS
FOR TRAINING AREAS

Site	MEC Source	Receptor Interaction			Explosive Hazards Exposure Rank
	Explosive Relative Risk Ranking	Accessibility	Future Land Reuse	Depth of Activity / Reuse	
M203 Practice Range co-located with Mortar Practice Range	7 ¹	Accessible	High	Subsurface / Tent and Yurt Camping	D

(1) Although Training Areas were ranked 4th on the MEC CSM relative risk ranking, a removal action was completed to a depth of two feet in this Practice Range Training area in 1999 resulting in a relative risk ranking of 7 (lowest ranking).

4.4.10 Range Safety Fans

4.4.10.1 The Range Safety Fan MEC Source sites consists of a total of sixteen (16) range safety fans associated with each of the sixteen Firing Point locations. Locations of the Range Safety Fans are shown in [Figure 4.7](#). Range Safety Fans are designed to contain those single event items that fall at some distance from their intended target. These items are sometimes referred to as undershoot and overshoot. Based on the range of artillery used at Camp Bonneville, it is possible that rounds could have impacted off the installation. The likelihood of encountering ordnance in a Range Safety Fan is negligible, because of the relatively large size of the Range Safety Fan. Note that small arms range safety fans are not considered in this explosive hazards exposure assessment due to the non-explosive nature of small arms.

4.4.10.2 Munition release mechanisms that may have resulted in the presence of MEC in Range Safety Fans are from single event deployed munitions that failed to function (UXO) and low-order detonation. Residual UXO poses the greatest explosive safety threat to the public as these items are fuzed and armed but failed to function. The

Figure 4.7 Range Safety Fan Map

explosive safety relative risk ranking for Range Safety Fans is 4 on a scale of 1 – 7 with 1 representing the highest explosive risk. Due to the very low probability for encountering UXO in Range Safety Fans at Camp Bonneville, the explosive hazards exposure assessment ranking for Range Safety Fan OE Source sites is Rank D. The explosive hazards exposure characteristics associated with the Range Safety Fans is summarized in [Table 4.7](#).

**TABLE 4.7
SUMMARY OF EXPLOSIVE HAZARDS EXPOSURE CHARACTERISTICS
FOR RANGE SAFETY FANS**

Site	MEC Source	Receptor Interaction			Explosive Hazards Exposure Rank
	Explosive Relative Risk Ranking	Accessibility	Future Land Reuse	Depth of Activity / Reuse	
Range Safety Fans	4	Accessible	Low - High	Surface and Subsurface / Varied ¹	D

(1) Future land use associated with the Range Safety Fans is varied but predominantly includes the Wildlife Management Area. Other reuse includes surface and subsurface activities within the proposed Regional Park. These various activities are identified and discussed in detail in the land reuse section.

4.4.11 Storage Magazines/Transfer Points

4.4.11.1 The solitary Storage magazine / Transfer Point MEC Source site at Camp Bonneville is Building 2950. Building 2950 area is an ammunition storage area consisting of three bunkers located approximately 1000 feet northeast of the Camp Bonneville cantonment area ([Figure 4.8](#)). The bunkers were inspected during the ASR Site Visit in 1997 and the western bunker was locked and found to contain black powder and rifle powder (smokeless). The black powder and rifle powder were subsequently disposed of under a contract issued by the Seattle District Corps of Engineers to Garry Struthers Associates, Inc. (Warren Fjeldos, personal communication). The other two bunkers were open and empty during the ASR Site Visit. During the 2002 field reconnaissance effort, the ammunition storage area was found to be fenced and locked.

4.4.11.2 The munition release mechanism at Storage Magazines/Transfer Points results from mishandling, loss or burial. The likelihood of non-deployed military munitions to be present in the area is remote. If military munitions were present, they would likely be non-deployed and unfuzed. The hazard severity ranking for these non-deployed military munitions is very low (negligible explosive safety hazard). The explosive safety relative risk ranking is 5 on a scale of 1 – 7 with 1 representing the highest explosive risk.

4.4.11.3 Building 2950 is currently fenced and secure with a high-security padlock. The current land use is institutional. The future land use is recreational and has a medium reuse intensity as there are no proposed reuse activities planned at this location. The overall explosive hazards exposure is Rank E is on a scale of A – E with A representing the greatest exposure risk. [Table 4.8](#) summarizes the exposure characteristics and ranking of the Building 2950 Storage Magazine/Transfer Point.

Figure 4.8 Storage Magazine/Transfer Point Location Map

TABLE 4.8
SUMMARY OF EXPLOSIVE HAZARDS EXPOSURE CHARACTERISTICS
FOR STORAGE MAGAZINE/TRANSFER POINT

Site	MEC Source	Receptor Interaction			Explosive Hazards Exposure Rank
	Explosive Relative Risk Ranking	Accessibility	Future Land Reuse	Depth of Activity / Reuse ¹	
Building 2950	5	Inaccessible	Medium	NA / Regional Park	E

⁽¹⁾ The level of subsurface intrusion or depth of activity is designated as not applicable (NA) for those sites that are not located in high reuse intensity areas.

4.4.12 Maneuver Areas

4.4.12.1 Maneuver Areas are those areas that were not specifically identified on maps as training areas. Maneuver Areas overlay in many places with range safety fans because of the number and size of the range safety fans. Maneuver Areas included the roads and trails, bivouac, and maneuver areas, including the Killpack and Bonneville cantonment areas ([Figure 4.9](#)). In the Maneuver Areas, pyrotechnics and blank ammunition were typically employed to evaluate the reactionary responses of troops and convoys to an ambush and to train in tactics. Military munitions containing high explosives were not used for reactionary training in maneuver areas.

4.4.12.2 There is a remote possibility that pyrotechnic devices (i.e. flares, smoke grenades) may be present as a result of abandonment, mishandling, or loss in Maneuver Areas. Any residual non-deployed pyrotechnics that may be present are potentially flammable, and may contain a small, low explosive charge that may cause bodily injury. However, large portions of the pyrotechnics were constructed with fiberboard containers and are therefore extremely susceptible to exposure to the elements and resultant weathering. Over time, the photo-flash powder has likely been exposed to moisture and deteriorated. The hazard severity ranking for Maneuver Areas is considered extremely low (negligible explosive safety hazard). The explosive safety relative risk ranking for Maneuver Areas is 6 on a scale of 1 – 7 with 1 representing the highest explosive risk.

4.4.12.3 Maneuver Areas are located throughout Camp Bonneville and are accessible by roads and trails. The future reuse intensity of Maneuver Areas ranges from low intensity for those areas in the proposed WMA, to high intensity in proposed future use areas located in the regional park. Because of its extremely low explosive safety risk, those areas where a Maneuver Area overlays a designated area with camping, construction, or other subsurface intrusive activities, the explosive hazards exposure assessment ranking is Rank E on a scale of A – E with A representing the greatest exposure risk. The explosive hazards exposure characteristics associated with Maneuver Areas is summarized in [Table 4.9](#).

Figure 4.9 Maneuver Area Location Map

TABLE 4.9
SUMMARY OF EXPLOSIVE HAZARDS EXPOSURE CHARACTERISTICS
FOR MANEUVER AREAS

Site	MEC Source	Receptor Interaction			Explosive Hazards Exposure Rank
	Explosive Relative Risk Ranking	Accessiblity	Future Land Reuse	Depth of Activity / Reuse ¹	
Maneuver Areas	6	Accessible	Low – High	Surface and Subsurface / Varied ¹	E

(1) Future land use associated with the Maneuver Areas is varied but predominantly includes the Wildlife Management Area. Other reuse includes surface and subsurface activities within the proposed Regional Park. These various activities are identified and discussed in detail in the land reuse section.

4.4.13 Central Impact Area

4.4.13.1 The Central Impact Area is 465 acres in size. It is comprised of the 83 acre Central Impact Target Area and 382 acres of associated Range Safety Fans ([Figure 4.10](#)). As such, the Central Impact Area has ordnance-related characteristics common to both Target Area and Range Safety Fan MEC Source site types. The Central Impact Area Targets (83 acres) were discussed previously in Section 4.4.6. The remaining Central Impact Area (382 acres) was selected for explosive hazard exposure assessment due to its remote location and its varied MEC exposure characteristics, suggesting that this area may require a unique risk management strategy. The entire Central Impact Area is wholly fenced off with a three-strand barbed wire fence encircling the area. Additionally, signage warning of the potential danger to trespassers is in place.

4.4.13.2 Munition release mechanisms that may have resulted in the presence of MEC in the vicinity of the Central Impact Area are from deployed munitions that failed to function. Residual HE-filled UXO items potentially present in the Central Impact Area pose the greatest hazard severity ranking of all site types. The likelihood that additional UXO items are present in the Central Impact Area is considered low – medium as the vast majority of the Central Impact Area is located within the Range Safety Fans. The high severity ranking and low – medium presence of additional UXO result in an explosive safety relative risk ranking of 3 on a scale of 1 – 7 for the Central Impact Area.

4.4.13.3 The overall accessibility of the Central Impact Area is considered limited as the entire site is fenced and signed, while only a small portion of this site is accessible by four-wheel drive road. The vast majority of the Central Impact Area is either limited or inaccessible due to very steep terrain. It is designated as low reuse intensity since it is located within the Wildlife Management Area. There are no overlying proposed future use sites or facilities planned in this area. People are not expected to venture into the area because of the fencing, signage, and steep terrain; therefore the number of potential human receptors is considered negligible. The low – medium likelihood of an MEC source combined with the very limited number of potential receptors in the area, result in

Figure 4.10 Central Impact Area Location Map

an explosive hazards exposure assessment ranking of Rank C. The explosive hazards exposure characteristics associated with the Central Impact Area is summarized in [Table 4.10](#).

**TABLE 4.10
SUMMARY OF EXPLOSIVE HAZARDS EXPOSURE CHARACTERISTICS
FOR CENTRAL IMPACT AREA**

Site	MEC Source	Receptor Interaction			Explosive Hazards Exposure Rank
	Explosive Relative Risk Ranking	Accessibility	Future Land Reuse	Depth of Activity / Reuse ¹	
Central Impact Area	3	Limited	Low	NA / Wildlife Mgt Area	C

⁽¹⁾ The level of subsurface intrusion or depth of activity is designated as not applicable (NA) for those sites that are not located in high reuse intensity areas. No reuse is proposed for this area.

4.4.14 Summary of Exposure Hazards by Primary Source Types

4.4.14.1 Each of the MEC Source sites identified in the site characterization were evaluated as part of this MEC risk assessment. Several Training Area sites were determined not to pose any explosive safety risk and were screened out of the exposure hazards assessment. In general, Target Areas, Firing Points and OB/OD Areas were determined to pose the greatest explosive safety exposure hazard; the remaining site types pose a negligible risk. [Figure 4.11](#) shows the exposure hazard by MEC Source type and [Table 4.11](#) summarizes the scoring results.

4.4.15 Exposure Hazards Assessment by Land Reuse Type

4.4.15.1 The foregoing exposure hazards assessment addresses the interaction between MEC source areas and future human activities based on the proposed land use designated as part of the planned regional park. Other types of future land use areas were also selected for risk analysis in order to determine if they require a specific risk management strategy. The following land reuse areas were evaluated in this analysis:

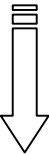
- Roads and Trails;
- High Intensity Reuse Areas;
- Medium Intensity Reuse Areas;
- High Accessible – Medium Intensity Reuse Areas; and
- Wildlife Management Area.

4.4.16 Roads and Trails

4.4.16.1 There are approximately 46 miles of Roads and Trails throughout Camp Bonneville of which 21 miles are located within the proposed regional park ([Figure 4.12](#)).

Figure 4.11 Explosive Hazards Exposure Ranking by OE Source Site

**TABLE 4.11
SUMMARY OF EXPLOSIVE HAZARDS EXPOSURE CHARACTERISTICS FOR
PRIMARY SOURCE TYPES**

Explosive Safety Relative Risk Ranking	Primary Source	Accessibility Factor								
		Accessible	Limited	Inaccessible	Accessible	Limited	Inaccessible	Accessible	Limited	Inaccessible
		Future Use Intensity								
		Low			Medium			High		
7 Least Risk	Training Area							D		
	Maneuver Area	E			E			E		
	Storage Magazines/Transfer Point						E			
	Range Safety Fan	D	D	D	D	D	D	D		
	Firing Point				C			B		
	Open Burn/Open Detonation Area	B			A			A		
1 Most Risk	Target Area	B			D	A		A	A	
Explosive Hazards Exposure: A = Highest Hazard Level E = Lowest Hazard Level								Shaded conditions are not present at Camp Bonneville.		

The Roads and Trails have the same munition related historical use and characteristics as the Maneuver Areas. Roads and Trails were segregated for analysis because of the greater potential for human use which may require a different risk management strategy.

4.4.16.2 The reconnaissance efforts resulted in 100% coverage of Roads and Trails in Camp Bonneville. The only items recovered within a 50-foot buffer along the Road and Trails during the reconnaissance were expended pyrotechnics and small arms ammunition. The hazard severity ranking for Roads and Trails is the same as Maneuver Areas and is considered extremely low (i.e., negligible explosive safety hazard and remote likelihood of contamination). The explosive safety relative risk ranking for Roads and Trails is 6 on a scale of 1 – 7 with 1 representing the highest explosive risk.

4.4.16.3 Roads and Trails are located throughout Camp Bonneville. The future reuse intensity of Roads and Trails is considered high. In addition to pedestrian and equestrian traffic, maintenance will be conducted along the Roads and Trails. These activities are non-intrusive. The explosive hazards exposure assessment ranking for Roads and Trails is Rank E, despite the relatively large number of potential receptors, because of its negligible explosive safety risk. The explosive hazards exposure characteristics associated with Roads and Trails is summarized in [Table 4.12](#).

Figure 4.12 Roads and Trails

TABLE 4.12
SUMMARY OF EXPLOSIVE HAZARDS EXPOSURE CHARACTERISTICS
FOR ROADS AND TRAILS

Site	MEC Source	Receptor Interaction			Explosive Hazards Exposure Rank
	Explosive Relative Risk Ranking	Accessibility	Future Land Reuse	Depth of Activity / Reuse	
Roads and Trails	6	Accessible	High	Surface / Hiking and Horseback Riding	E

4.4.17 High Intensity Reuse Areas

4.4.17.1 The proposed Clark County Regional Park has approximately 210 acres of specific reuse activity sites, based on the January 2003 Camp Bonneville Preliminary Site Plan ([Figure 4.13](#)). This explosive hazards exposure assessment has designated these areas as High Intensity Reuse Areas. Those portions of High Intensity Reuse Areas that overlie an MEC Source site are addressed within that MEC Source risk analysis, and will be carried forward in the feasibility study. The remaining High Intensity Reuse Areas are categorized as having the munition activity and MEC characteristics of a Maneuver Area. Camp Bonneville in its entirety is considered a Maneuver Area, and barring other information, this designation is applied to the High Intensity Reuse Areas located within the proposed regional park. The hazard severity ranking for High Reuse Areas are defined to be equivalent to a Maneuver Area (i.e., negligible explosive safety hazard) and the likelihood of ordnance contamination is remote. The explosive safety relative risk ranking for High Reuse Areas is 6 on a scale of 1 – 7 with 1 representing the highest explosive risk.

4.4.17.2 The greatest amount of human activity will occur in the High Intensity Reuse Areas. Examples of intrusive activities include tent camping and construction. Non-intrusive activities include RV camping, parking, archery or firing range training. Because of the relatively large number of receptors in the High Intensity Reuse Areas, the explosive hazards exposure assessment ranking for High Intensity Reuse Areas is Rank D. The explosive hazards exposure characteristics associated with High Intensity Reuse Areas is summarized in [Table 4.13](#).

4.4.18 High Accessible - Medium Intensity Reuse Areas

4.4.18.1 High Accessible-Medium Intensity Reuse Areas consists of selected areas within the proposed regional park that are located between High Intensity Reuse Areas. A High Accessibility Area is defined as area that generally has a gentle topographic slope (<15%) and has low vegetative cover. These sites provide the opportunity to draw people together for informal recreational activities, such as ball toss, Frisbee games and picnic areas. The High Accessible-Medium Intensity Reuse Areas comprise approximately 180 acres within the proposed regional park as shown in [Figure 4.14](#). The High Accessible-Medium Intensity Reuse Areas have the same ordnance related historical use and

Figure 4.13 Proposed High Intensity Reuse Areas

Figure 4.14 High – Accessible Medium Intensity Reuse Area

characteristics as the High Intensity Reuse Areas, categorized as Maneuver Areas (i.e., negligible explosive safety hazard and remote likelihood of contamination).

TABLE 4.13
SUMMARY OF EXPLOSIVE HAZARDS EXPOSURE CHARACTERISTICS
FOR HIGH INTENSITY REUSE AREAS

Site	MEC Source	Receptor Interaction			Explosive Hazards Exposure Rank
	Explosive Relative Risk Ranking	Accessibility	Future Land Reuse	Depth of Activity / Reuse	
High Intensity Reuse Areas	6	Accessible	High	Surface and Subsurface / Varied	D

4.4.18.2 The High-Accessible Medium Intensity Reuse Areas differ only from the High Intensity Reuse Areas in the number of people and type of activities likely to occur in these areas. The High-Accessible Medium Intensity Reuse Areas are categorized to be those areas where people may gather to conduct impromptu recreational activities. These recreational activities are likely to be surficial, non-intrusive activities. A moderate number of people are expected to enter the High-Accessible Medium Intensity Reuse Areas. The explosive hazards exposure assessment ranking for Highly Accessible Medium Intensity Reuse Areas is Rank D due to the moderate number of potential receptors in the Highly Accessible Medium Intensity Reuse Areas and negligible explosive risk rating. The explosive hazards exposure characteristics associated with Highly Accessible Medium Intensity Reuse Areas is summarized in [Table 4.14](#).

TABLE 4.14
SUMMARY OF EXPLOSIVE HAZARDS EXPOSURE CHARACTERISTICS
FOR HIGH ACCESSIBLE -MEDIUM INTENSITY REUSE AREAS

Site	MEC Source	Receptor Interaction			Explosive Hazards Exposure Rank
	Explosive Relative Risk Ranking	Accessibility	Future Land Reuse	Depth of Activity / Reuse	
High- Accessible Medium Intensity Reuse Areas	6	Highly Accessible	Medium	Surficial / Recreation	D

4.4.19 Remaining Medium Intensity Reuse Areas

4.4.19.1 The Remaining Medium Intensity Reuse Areas ([Figure 4.15](#)) consist of those areas within the proposed Regional Park that are located between specific designated reuse areas, and do not have the high accessibility characteristics of gentle slope and low vegetation characteristics. The Remaining Medium Intensity Reuse Areas comprise approximately 786 acres, and have the same ordnance related historical use and

Figure 4.15 Remaining Medium Intensity Reuse Area

characteristics as the High Intensity Reuse Areas, categorized as Maneuver Areas (i.e., negligible explosive safety hazard and remote likelihood of contamination).

4.4.19.2 The Remaining Medium Intensity Reuse Areas differs from the High Intensity Reuse Areas in the number of people and the types of activities likely to occur in these areas. Very few people are expected to enter the Remaining Medium Intensity Reuse Areas, as most people would be expected to use the accessible Roads and Trails, and these areas have significant vegetative cover and or moderate-steep terrain characteristics. The anticipated activities within this area are limited to walking. The explosive hazards exposure assessment ranking for Remaining Medium Intensity Reuse Areas is Rank E based on the small number of potential receptors in the Remaining Medium Intensity Reuse Areas. The explosive hazards exposure characteristics associated with Accessible Medium Intensity Reuse Areas is summarized in [Table 4.15](#).

TABLE 4.15.
SUMMARY OF EXPLOSIVE HAZARDS EXPOSURE CHARACTERISTICS
FOR ACCESSIBLE MEDIUM INTENSITY REUSE AREAS

Site	MEC Source	Receptor Interaction			Explosive Hazards Exposure Rank
	Explosive Relative Risk Ranking	Accessibility	Future Land Reuse	Depth of Activity / Reuse	
Accessible Medium Intensity Reuse Areas	6	Accessible	Medium	Surficial / Short-cuts	E

4.4.20 Wildlife Management Area

4.4.20.1 The Wildlife Management Area is comprised of approximately 2307 acres and includes the DNR leased lands ([Figure 4.16](#)). The Wildlife Management Area does not include the Central Impact Area which requires a separate risk management strategy and is addressed separately above. The majority of the Wildlife Management Area overlies one or more Range Safety Fans.

4.4.20.2 The Wildlife Management Area is categorized as having the ordnance related historical use and characteristics similar to those as the Range Safety Fans (critical/catastrophic explosive safety risk and low likelihood of munition contamination). The explosive safety relative risk ranking for the Wildlife Management Area is 4 on a scale of 1 – 7 with 1 representing the highest explosive risk similar to Range Safety Fans.

4.4.20.3 The overall accessibility of the Wildlife Management Area is considered limited as only a small portion of this site is accessible by road. The vast majority of the Wildlife Management Area is categorized as either limited or inaccessible due to very steep terrain. It is designated as low reuse intensity, with no overlying proposed future use sites or facilities planned in this area. Timber harvesting and subsequent timber planting are the sole human activities proposed for the Wildlife Management Area.

Figure 4.16 Wildlife Management Area

People are not expected to venture into the area because of the steep terrain; therefore the number of potential human receptors is considered very low. The low likelihood of an MEC source combined with the very limited number of potential receptors in the area, result in an explosive hazards exposure assessment ranking of Rank D. The explosive hazards exposure characteristics associated with the Wildlife Management Area is summarized in [Table 4.16](#).

TABLE 4.16
SUMMARY OF EXPLOSIVE HAZARDS EXPOSURE CHARACTERISTICS
FOR WILDLIFE MANAGEMENT AREA

Site	MEC Source	Receptor Interaction			Explosive Hazards Exposure Rank
	Explosive Relative Risk Ranking	Accessibility	Future Land Reuse	Depth of Activity / Reuse	
Wildlife Management Area	4	Accessible	Low	Surface and Subsurface / Silviculture, Short-cuts	D

4.4.21 Summary of Exposure Hazards by Land Use

4.4.21.1 Each of the Clark County proposed land reuse areas identified for Camp Bonneville was evaluated as part of this risk assessment. None of these proposed reuse areas were determined to pose an appreciable explosive exposure hazard based on an evaluation of the MEC source and receptor interaction.